Content
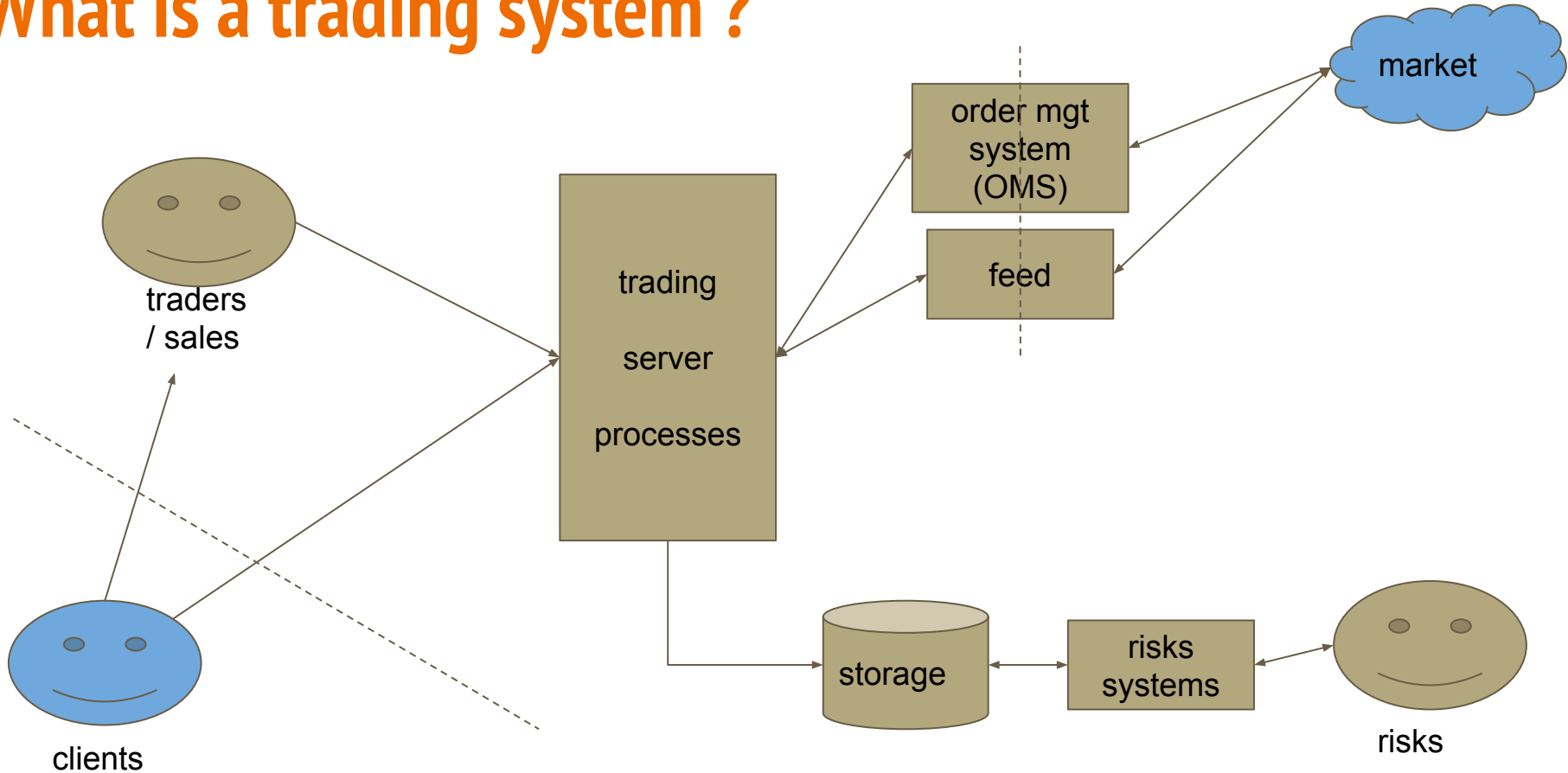
- actors
  - exchanges, banks, hedge funds, corporation, governments, central banks …

- instruments
  - cash, derivatives, optional,

- trading systems
  - exchange matching engine, contribution engine, negotiation engine

Trading Systems

Fabien Carmagnac - 2018

What is a trading system ?

What is a trading system ?

What is a trading system ?

A front office system able to automate some part of trading process and protect users (sales, traders, it) from some part of risk, including :

- handle order events : execution, creation, cancellation, etc.
- gather information : prices, macro-economics figure, twitter, weather, etc.
- control risks : exposure, tiering, forbidden instruments, etc.
- execute trader actions : start algo, adjust volatility, quote instrument, etc.

Components :

- applicative processes, persistance processes (database)
- message bus for communication

Why a trading system ?
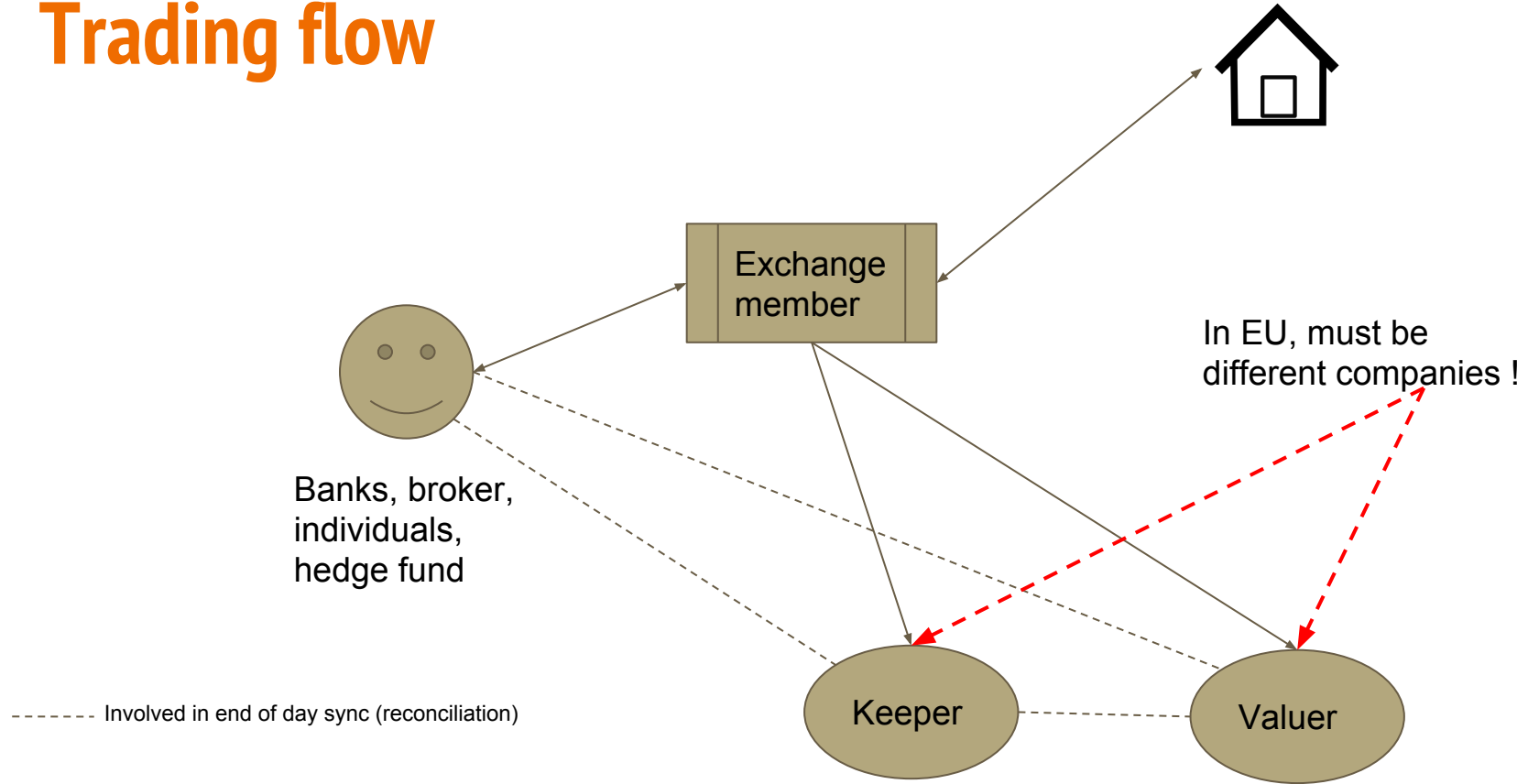
Why a trading system ?

Volume !

Compliance !

Automate dealing capacity

Avoid human errors VS control the system

Who needs a trading system ?

Trading flow

Exchange member

In EU, must be different companies !

Banks, broker, individuals, hedge fund

Keeper

Valuer

- - - - - Involved in end of day sync (reconciliation)

Exchange needs a trading system

Revenue generated by crossing buyers and sellers (~ few $ per 100K$ executed)

Offer informations ⇒ index, static data, volume

Creation of different execution ⇒ toolbox for customers

In case of problem ⇒ easy to trace events

Brokers need a trading system

Revenue comes from passing orders to exchange (~ few $ per 100K$ executed)

Hub/routing role ⇒ heterogeneous systems ?

Tools for clients ⇒ reporting, testing, indicator publishing

Banks needs a trading system

Revenu come from dealing financial products ⇒ bubble ?

Allow volume, throughput ⇒ limits ?

Edge capacity needed to nullify risks ⇒ handle market shocks ?

In order to ensure equality of clients ⇒ evil is in details

Hedge funds needs a trading system

Diversify markets and instruments ⇒ liquidity vs capacity

Technology as competitive advantage ⇒ speed, reactiveness

Reduce human risk ⇒ easy to guarantee "they do what they say" by regulator

Relationship between R&D and trading ⇒ improve performance

Where are trading systems ?

Where are trading systems ?

On exchange servers (hosting)

In data centers

In actors office but compliance needs more !

⇒ Trading system involves ~ 20 - 1000 cores

⇒ Risks : x 100 - 1000

Let's dig !

Order book

The order book represents the buyers and sellers

Only limit orders appear so clients can see the liquidity

Order types : market, stop, stop limit, limit, IOC (immediate or cancel), FOK (fill or kill), etc …

Parameters : duration (GTC, GTD), price, quantity, side, instrument, account, trader name

Order book

SPDR S&P 500 ETF TR TR UNIT

Orders Accepted
1,153,586

Total Volume
7,689,062

	TOP OF BOOK		LAST 10 TRADES		
	SHARES	PRICE	TIME	PRICE	SHARES
ASKS ↑	11,000	180.07	14:42:13	180.03	100
	12,500	180.06	14:42:11	180.02	100
	12,900	180.05	14:42:11	180.01	100
	9,700	180.04	14:42:09	180.01	100
	1,100	**180.03**	14:42:09	180.01	200
BIDS ↓	6,400	**180.02**	14:42:08	180.01	100
	9,700	180.01	14:42:06	180.01	100
	9,600	180.00	14:42:06	180.01	100
	14,700	179.99	14:42:06	180.01	100
	11,500	179.98	14:42:06	180.01	100

Exchange

Google : "exchange iso list" ⇒ a lot per countries !

Their goal is to maximise executions

They can publish "indexes" ⇒ not an instrument !

They offer members transaction fees for liquidity providers (limit orders)

Some of most famous: CME, NYSE, Euronext, …

Instrument

- Defined by
    - Name
    - Ticker/product id/symbol : unique identifier
    - Tick size, tick value, lot size
    - Trading hours
- For some (futures, options) :
    - Expiry
    - Delivery conditions
    - Settlement conditions at expiry

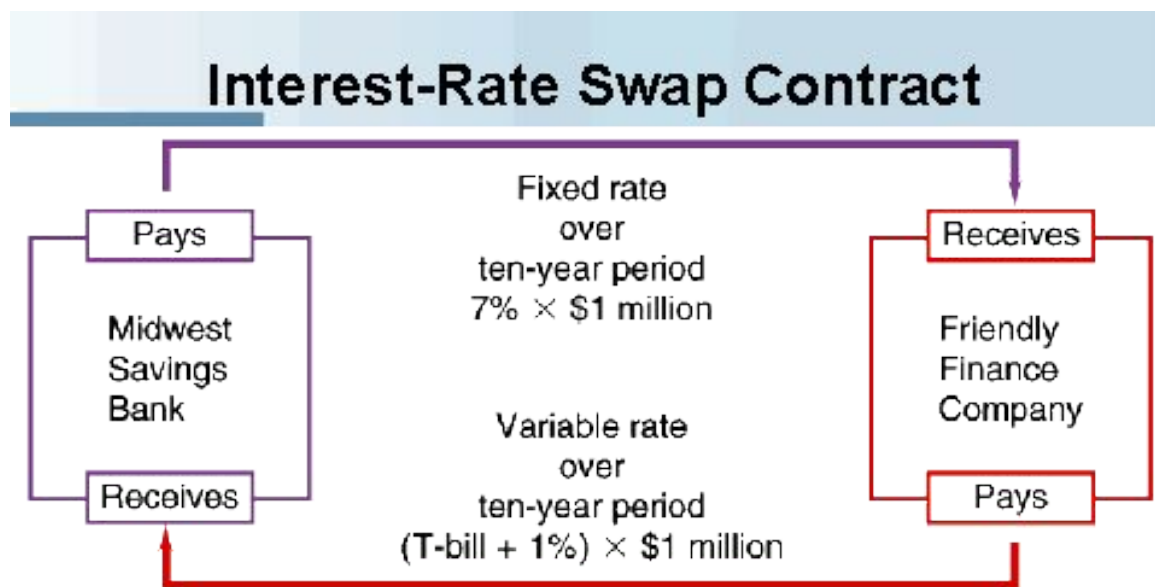# Asset classes

Asset classes

Rates : swap

Equity : shares

Forex : currencies

Credit : loans

Bonds : government bonds

Commodities : energy, metals, grain, …

http://www.finviz.com

Asset class : interest rates

Interest-Rate Swap Contract

Pays → Midwest Savings Bank → Receives

Fixed rate
over
ten-year period
7% × $1 million

Variable rate
over
ten-year period
(T-bill + 1%) × $1 million

Receives → Friendly Finance Company → Pays

1. Notional principle of $1 million
2. Term of 10 years
3. Midwest SB swaps 7% payment for T-bill + 1% from Friendly Finance Co.

Asset class : equity

A **share** represents a part of a company

PriceShare x NumberOfShares = Market Capitalization

Owners **receive** (or not) dividend : Price(t+1) = Price(t)+Dividend(t)

You pay **cash** , you receive **shares** (paper)

Technical difficulties of equity : **corporate actions** (split, dividend, etc.)

Asset class : forex

Currency pair XXXYYY : 1 XXX for XXXYYY of YYY

Ex: EURUSD : 1 EUR for 1.1652 USD

If XXXYYY does not exists, a Major currency is used as pivot (usually **USD**)

Used for all **quanto** products (cash flow in 2 currencies)

Sub-classes :

- Majors : **USD vs** EUR, CAD, JPY, AUD, GBP, CHF, NZD
- Minor : all others …

Asset class : credit

Loans for any economic actor for a **nominal**, a payment **period**, a **rate formula** (may be fixed), a **duration** :

- individuals : real-estate
- companies : any investment project

Rate depends from borrower's **rating**

The lender assumes the full **default** of the borrower

Example : for sub-prime product, rate is a function of the value of the house

Asset class : bonds

Bonds : like loans but issued by government bonds or corporations

Usually very large deal nominal

Ex: US T-Note (10Y), French OAT (10Y), German Bund

https://fr.investing.com/rates-bonds/world-government-bonds

Example : T Bonds

Just a paper ?

Difference between bonds and loans

Volume

Regulation

Life-insurance are full of bonds !

	Bond	Loan
Similarities	Both are methods for firms or government to borrow money. The firm/government will pay annual interest rate payments on both bonds and loans.	
Ownership	Bonds can be sold by governments or firms	Loans taken out by firms and consumers looking to borrow money
Interest rate	Interest rate usually fixed on a bond for period of bond.	Loans can be fixed rate, but often are variable – changing with base rates
Source	Bonds can be sold on bond market to public/financial institutions	Most loans given by banks
Trading	Bonds are often bought and sold on bond market. Value of bond can go up and down	Loans usually fixed with original bank
Examples	10-year US Treasury Bond	Variable bank loan
Interest rates	Government bond yields likely to be lower – seen as safe investment	Bank loans on unsecured lending can be quite high.

www.economicshelp.org

Asset classes : commodities

Commodities :

- energy : oil, heating oil, ethanol, ...   http://www.finviz.com
- metals : gold, silver, copper, platinium, uranium (regulated), ...
- grain : corn, wheat, soybean oil, ...
- meats : lean hogs, parmigiano cheese ...

Market movers : politics, weather

Seen as raw materials by industrial but limited production

Instrument : 2 examples

Futures : Crude Oil

https://www.cmegroup.com/trading/energy/crude-oil/light-sweet-crude_contract_specifications.html

Cash equity : L'Oréal

https://derivatives.euronext.com/en/products/stock-futures/OR6-DPAR/contract-specification